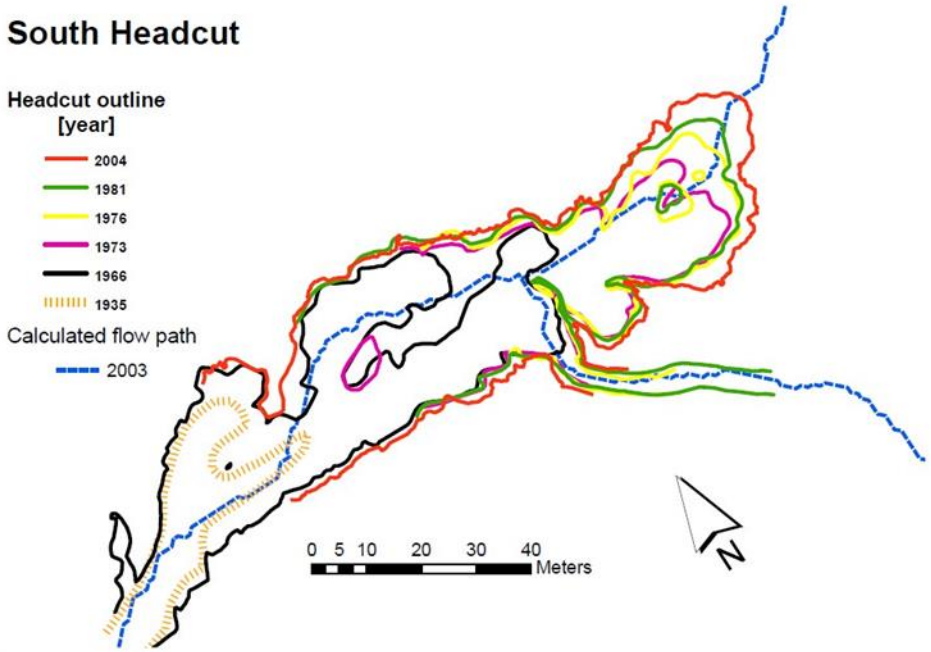
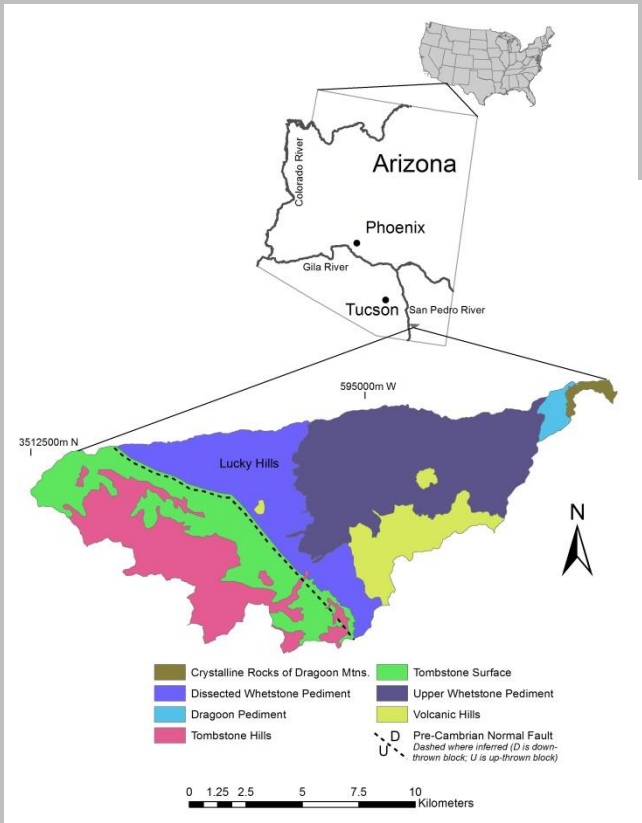
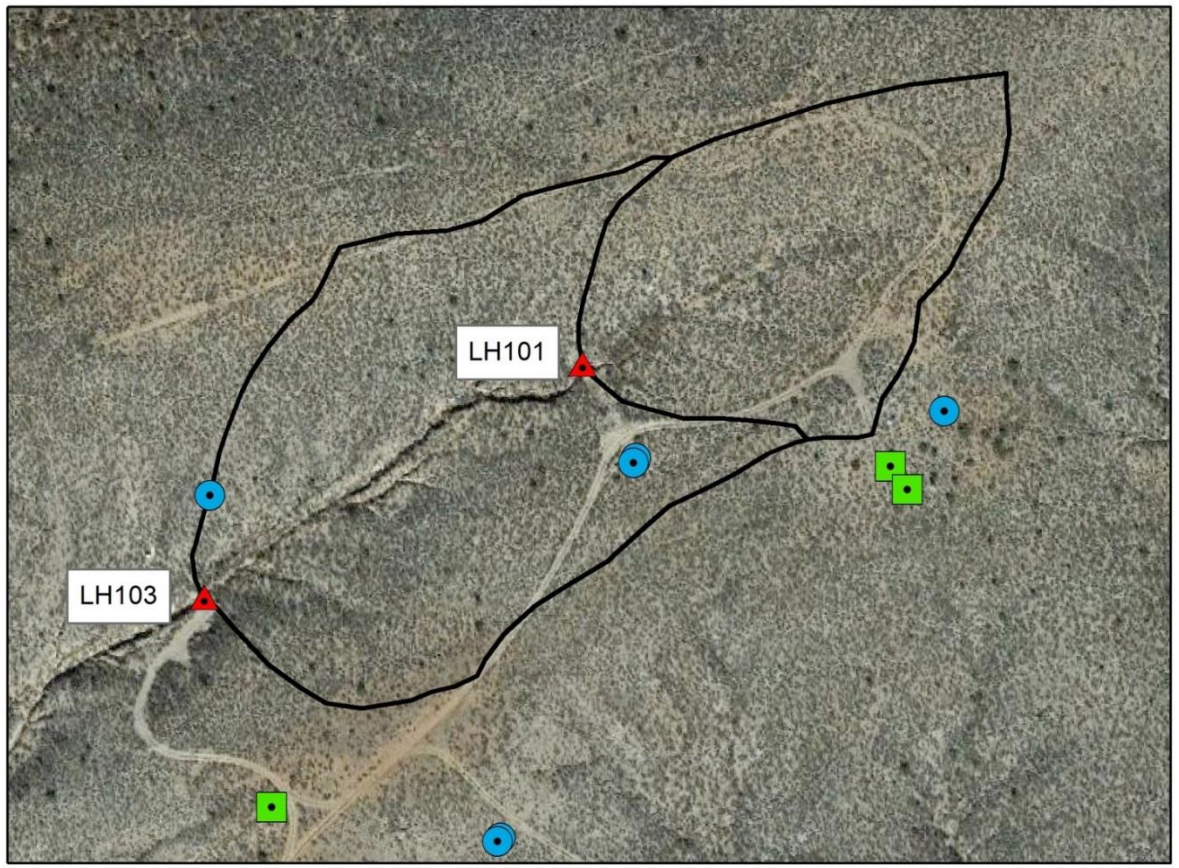
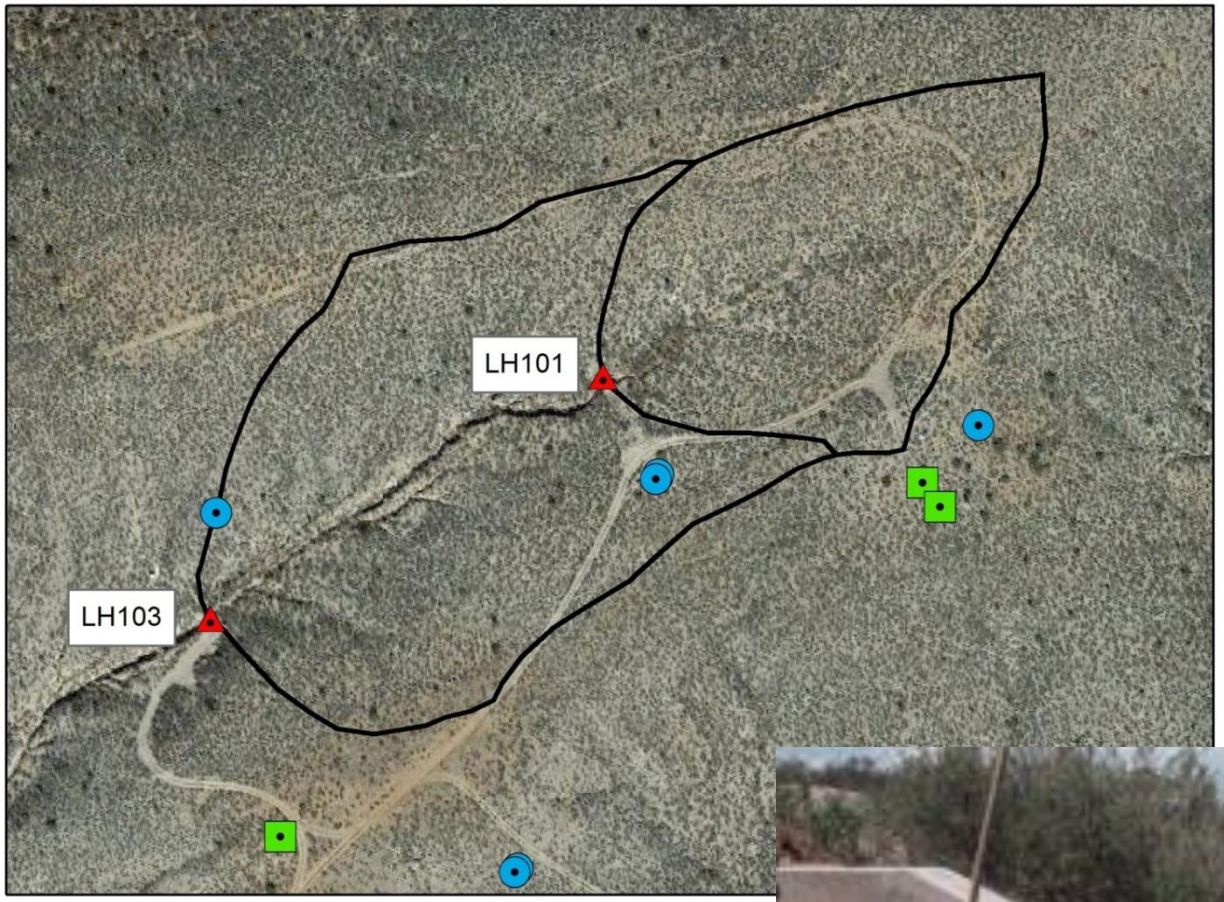
How do channels migrate uphill?
Observations from the Walnut Gulch Experimental Watershed

Mary Nichols and Mark Nearing


South Headcut
Headcut outline
[year]
2004
1981
1976
1973
1966
1935
Calculated flow path
2003
0 5 10 20 30 40
Meters
N


Arizona
Colorado River
Phoenix
Gila River
Tucson
San Pedro River
595000m W
3512500m N
Lucky Hills
N
Crystalline Rocks of Dragoon Mtns.
Dissected Whetstone Pediment
Dragoon Pediment
Tombstone Hills
Tombstone Surface
Upper Whetstone Pediment
Volcanic Hills
D
U
Pre-Cambrian Normal Fault
Dashed where inferred (D is down-thrown block; U is up-thrown block)
0 1.25 2.5 5 7.5 10
Kilometers


LH101
LH103
Recording Rain Gage
Runoff Measuring Station
Soil Moisture Sensor Profile
Watershed Boundary
N
0 25 50 100 150 200
Meters

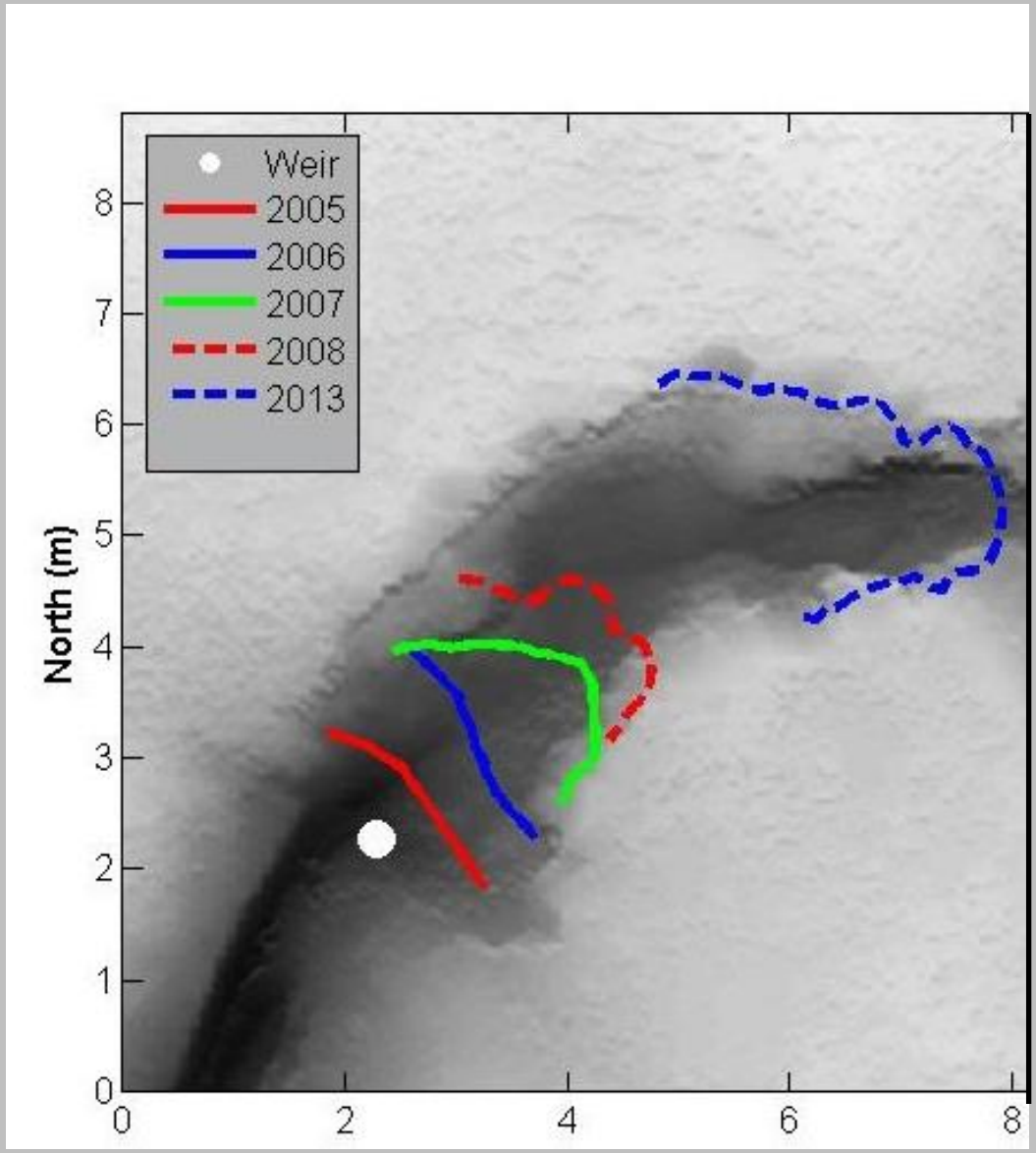


Recording Rain Gage
Runoff Measuring Station
Soil Moisture Sensor Profile
Watershed Boundary

N

0 25 50


2005


Weir
2005
2006
2007
2008
2013
North (m)
East (m)
0
1
2
3
4
5
6
7
8
0
2
4
6
8

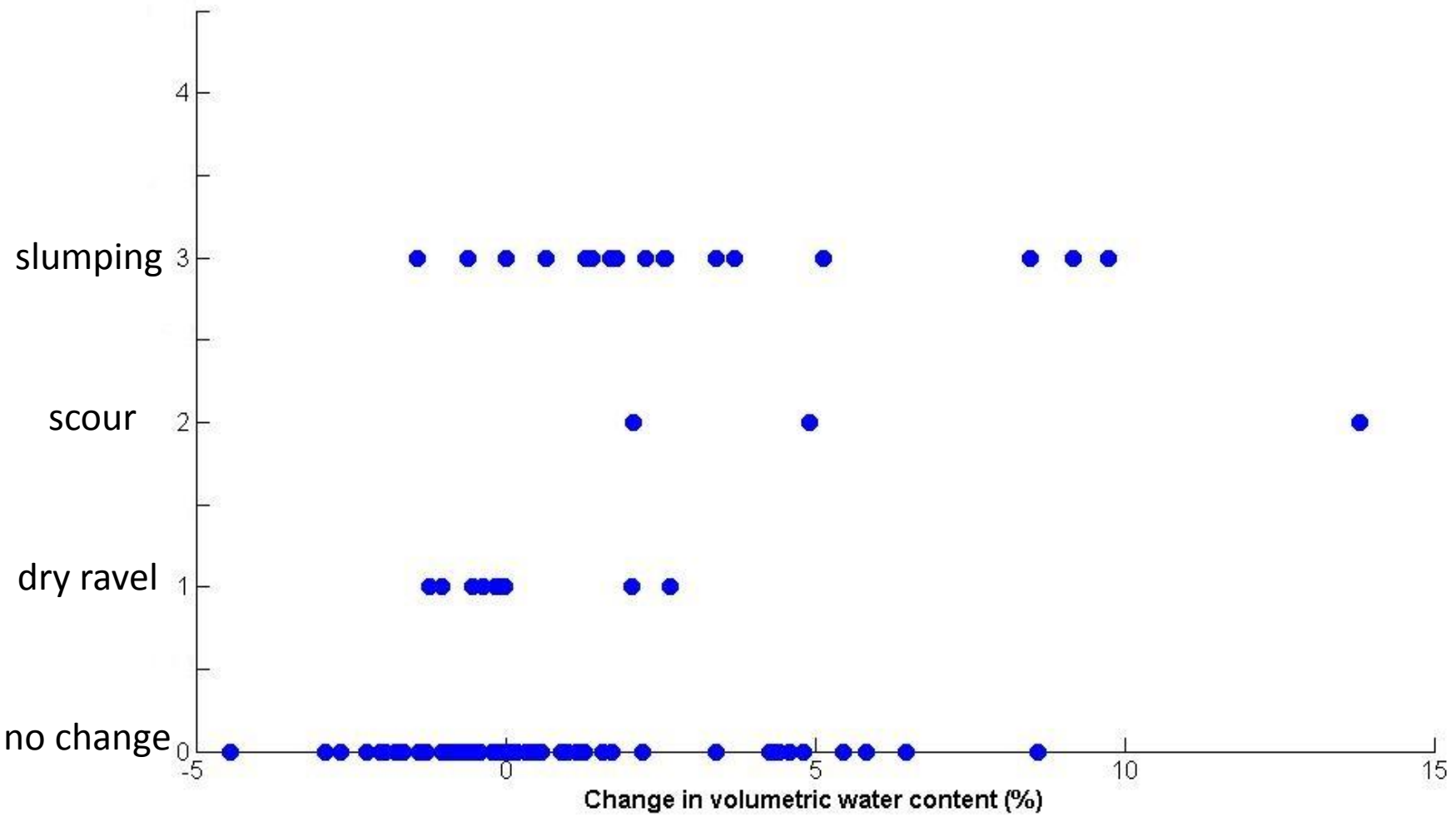

Canon
FUNC. SET
DISP.
MENU

July 4, 2012
Video

Evaluated all of the time-lapse sequences from 2012 through July 2014 and qualitatively described the dominant erosion processes:

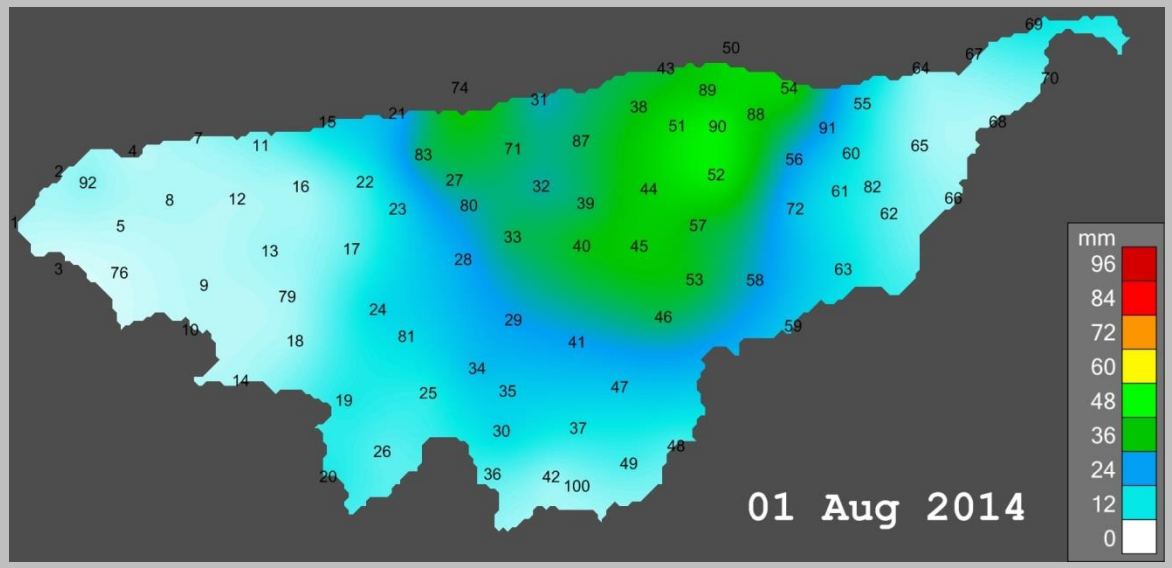
0	no change observed
1	dry ravel and minor sediment grain movement
2	scour at channel headwall or channel banks
3	slumping or plunge pool erosion

Classified processes were evaluated against the hydrologic drivers: rainfall, runoff, and change in water content (wetting or drying soil)



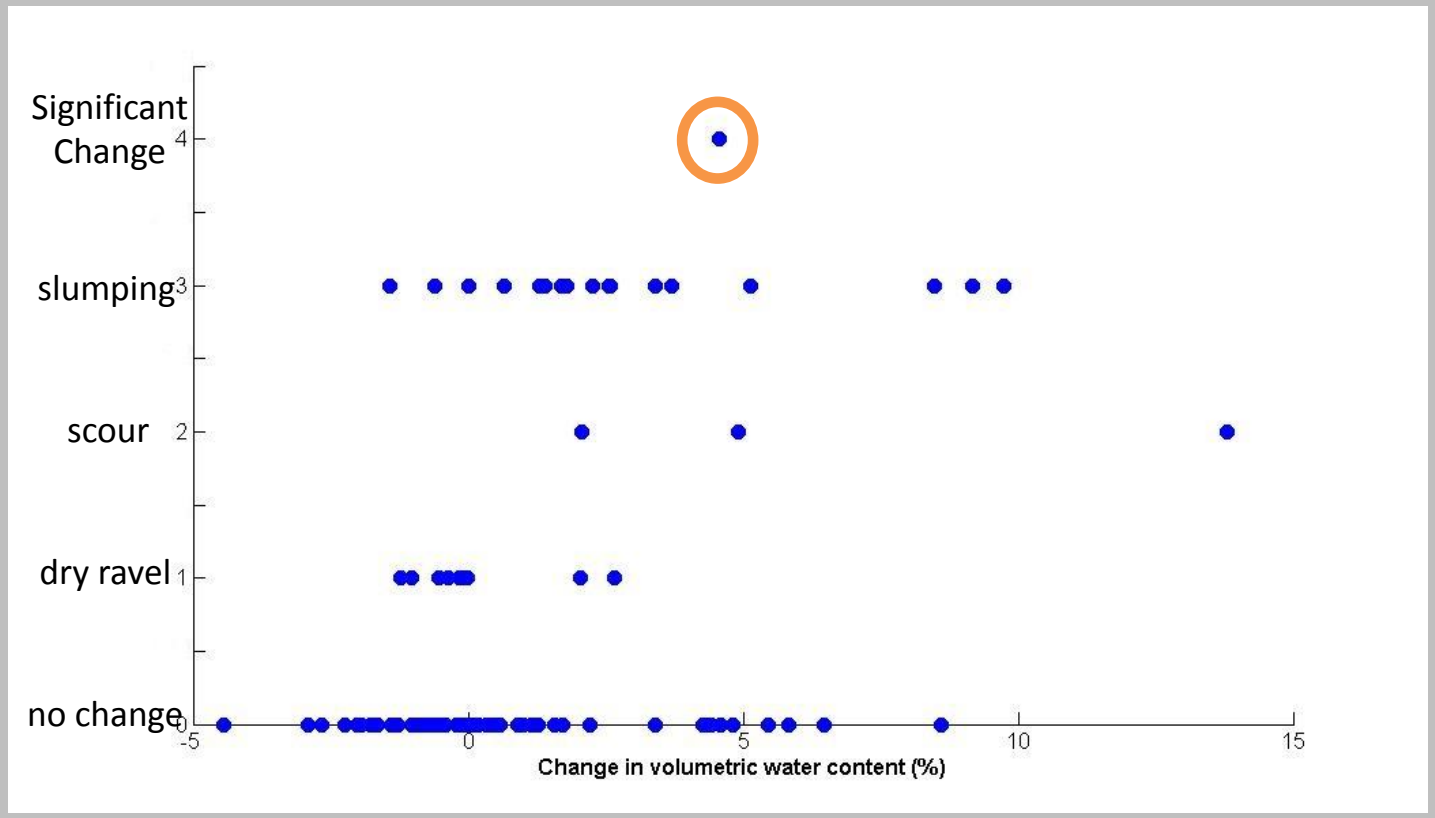
August 1, 2014
Video


August 1, 2014
USDA-ARS-WGEW
M. Nichols

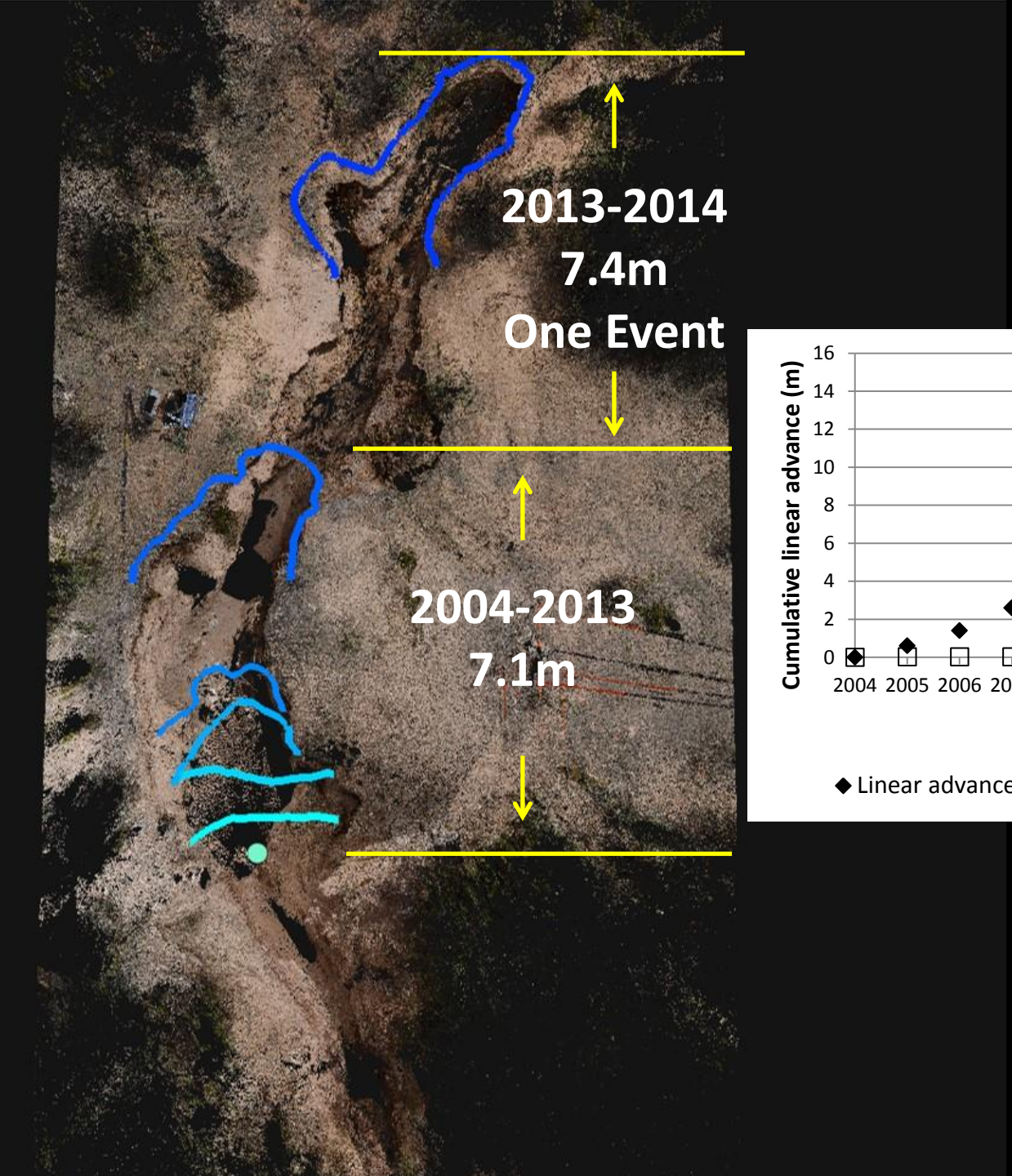


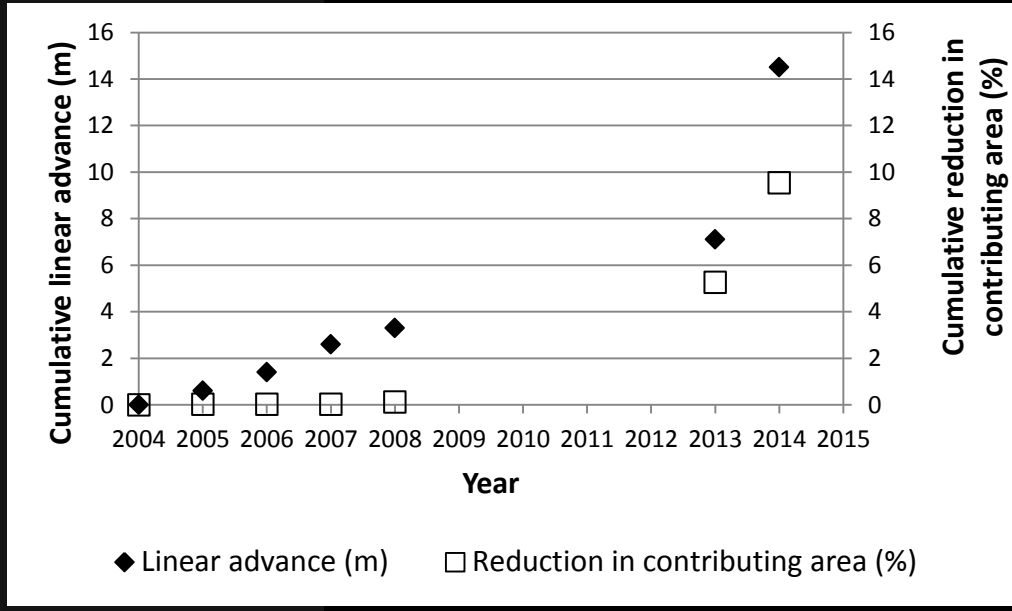
But it happened at night!
In the dark!

- Rainfall was not remarkable
- Runoff was not remarkable
- Change in water content was not remarkable

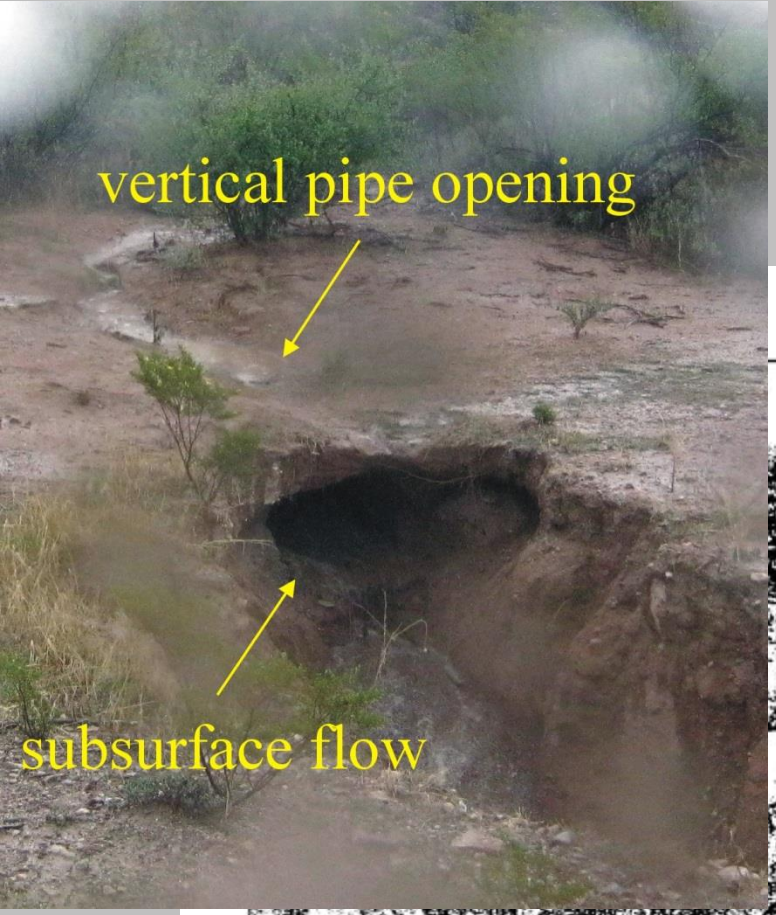


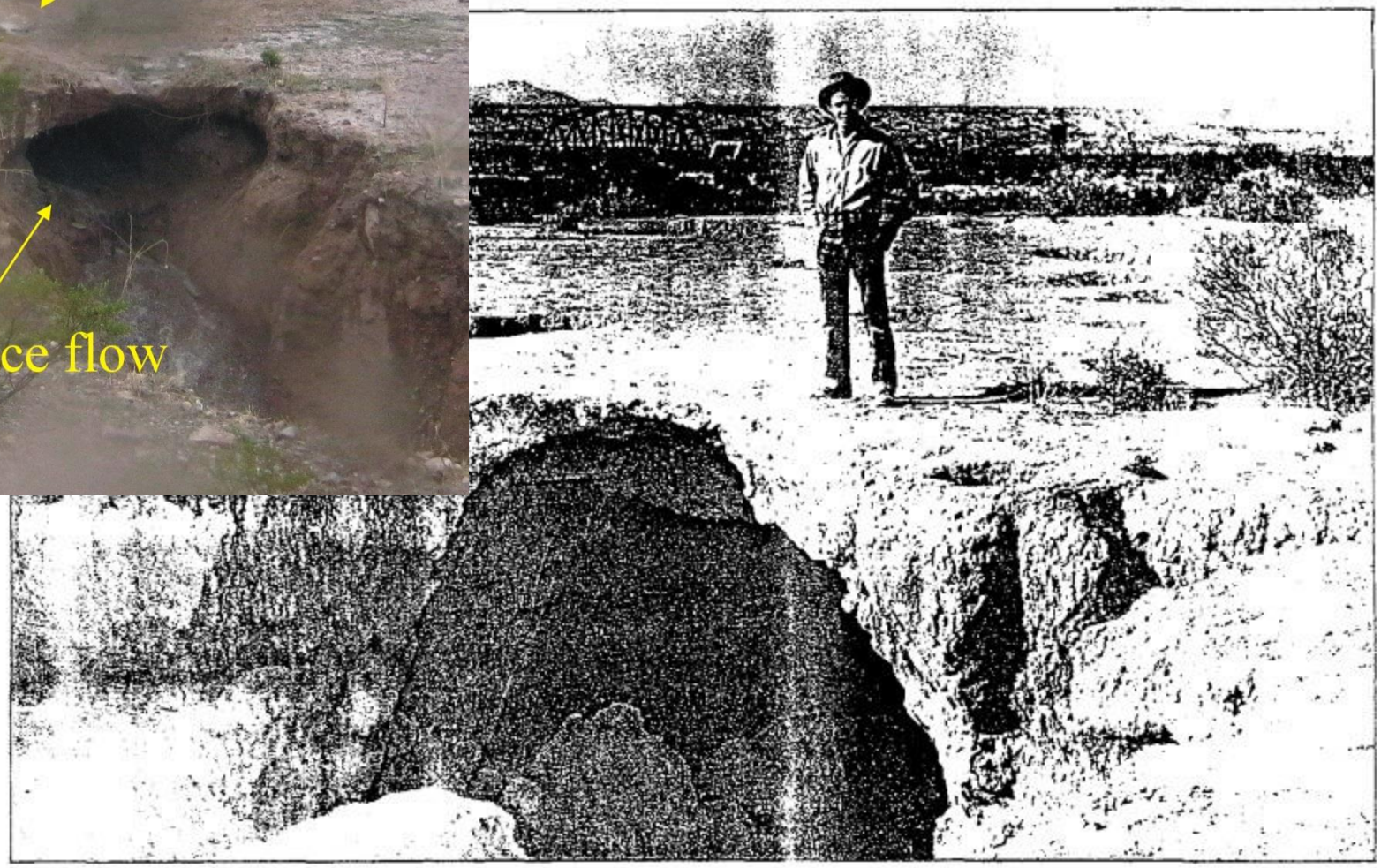

2014
Ground-based LiDAR


2013-2014
7.4m
One Event
2004-2013
7.1m


Cumulative linear advance (m)
Cumulative reduction in contributing area (%)
0
2
4
6
8
10
12
14
16
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
Year
Linear advance (m)
Reduction in contributing area (%)

July 25, 2014
Video





Destructive piping on an abandoned farm near Benson, Arizona.

Thanks:
Michelle Cavanaugh
Mark Kautz